

Serial No.: 10/615,086

Group Art Unit: 2813

REMARKS

Election/Restrictions

The Examiner acknowledged Applicants' election of claims 1-6 in the reply filed on 11/26/04, and indicated that because Applicants did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Applicants respectfully submit that claims 1-6 and claims 6-12 are for the same "Method of forming an integrated circuit" comprising a combination that includes:

"forming ultra-uniform silicides on the source/drain junctions;
...; and
forming contacts in the dielectric layer to the ultra-uniform silicides."

Rejoinder of claims 7-12 upon allowance of claims 1-6 is respectfully requested.

Claim Rejections - 35 USC §102

Claims 1 and 5-6 are rejected under 35 U.S.C. §102(a) as being anticipated by Applicants' admitted prior art (hereinafter "AAPA").

In reference to claim 1, the Examiner states:

"A method of forming an integrated circuit comprising:

...
forming ultra-uniform silicides on the source/drain junctions (Admitted prior art page 3, lines: 5-11);
...and
forming contacts in the dielectric layer to the ultra-uniform silicides (Admitted prior art page 2, lines: 30-35)."

Applicants respectfully disagree.

AAPA page 3, lines 5-11, states:

"The semiconductor wafer is subjected to one or more annealing steps at temperatures above 800°C and this causes the cobalt or titanium to selectively react with the silicon and the polysilicon to form the metal silicide. The process is generally referred to as "siliciding". Since the shallow trench oxide and the sidewall spacers will not react to form a silicide, the silicides are aligned over the source/drain junctions and the polysilicon gates so the process is also referred to as "self-aligned siliciding", or "saliciding"."

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AAPA page 2, line 30, through page 3, line 3, states:

"The contact openings are then filled with a conductive metal and interconnected by formation of conductive wires in other dielectric layers.

As transistors have decreased in size, it has been found that the electrical resistance between the metal contacts and the silicon substrate or the polysilicon has increased to the level where it negatively impacts the performance of the transistors. To lower the electrical resistance, a transition material is formed between the metal contacts and the silicon substrate or the polysilicon. The best transition materials have been found to be cobalt silicide (CoSi₂) and titanium silicide (TiSi₂)."

It is respectfully submitted from the above that neither AAPA page 3, lines 5-11, nor AAPA page 2, line 30, through page 3, line 3, discloses forming ultra-uniform silicides or forming contacts to the ultra-uniform silicides.

Further, AAPA page 3, lines 12-18, confirm the lack of disclosure, teaching, or suggestion of the claimed invention by stating:

"However, existing siliciding and saliciding have not succeeded in solving all the problems related to connecting the metal contacts to silicon.

The problems include, but are not limited to, high resistance between metal contacts and the silicide.

Solutions to these problems have been long sought but prior developments have not taught or suggested any solutions and, thus, solutions to these problems have long eluded those skilled in the art."

Based on the above, it is respectfully submitted that claim 1 is allowable under 35 U.S.C. §102(a) as not being anticipated by AAPA because:

"Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, *arranged as in the claim.*" [emphasis added] Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co. (730 F.2d 1452, 221 USPQ 481, 485 (Fed. Cir. 1984)(citing Connell v. Sears, Roebuck & Co., 722 F.2d 1542, 220 USPQ 193 (Fed Dir. 1983)))

In reference to claim 5, this dependent claim depends from independent claim 1 and is believed to be allowable since it contains all the limitations set forth in the independent claim from which it depends and claims unobvious combinations thereof.

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In reference to claim 6, this dependent claim depends from independent claim 1 and is believed to be allowable since it contains all the limitations set forth in the independent claim from which it depends and claims unobvious combinations thereof. For example, AAPA does not disclose an ultra-uniform silicide.

It is respectfully submitted that the independent claim 1, and the respective claims 5 and 6 depending therefrom, are not anticipated by AAPA under 35 USC §102 and are not obvious in combination under 35 USC §103 with the other cited references.

Claim Rejections - 35 USC §103

Claims 2-4 are rejected under 35 U.S.C. §103(a) as being unpatentable over admitted prior art in further view of Saigal et al (US 6,579,783, hereinafter "Saigal").

In reference to claims 2-4, the Examiner states:

"In reference to claims 2-4, Admitted prior art fails to teach the power level, rate of deposition for the silicide layers. Moreover, Admitted prior art teaches that the silicide film is thin, however fails to explicitly teach where the silicide layer is no more than 50A thick.

It is respectfully submitted that Saigal specifically teaches away from the claimed invention in col. 3, lines 53-63:

"In one embodiment, the metal film 50 is deposited to a thickness having the lower limits of about 50 Angstroms or about 90 Angstroms to the upper limits of about 150 Angstroms, about 200 Angstroms, or about 250 Angstroms, with a range from any lower limit to any upper limit being within the scope of the present invention. One range of the thickness of the deposited metal film 50 is from about 50 Angstroms to about 150 Angstroms. Another range of the thickness of the deposited metal film 50 is from about 90 Angstroms to about 185 Angstroms."

These ranges end about where the claimed invention begins, but Saigal specifically is teaching a non-uniform silicide as explained in the Saigal Summary of the Invention in col. 2, lines 53-55:

"In one aspect of the invention, the metal film agglomerates and forms a discontinuous film over the dielectric spacers." [underlining for clarity]

Thus, Saigal does not teach or suggest an ultra-uniform silicide, but teaches a non-uniform silicide that is even discontinuous.

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Further with regard to claims 2-4, the Examiner states:

"However Saigal et al. teaches the limitations of claims 2-4 as follows:

The method as claimed in claim 1 wherein forming the ultra-uniform silicides uses a very low power deposition technique using a power level below 500 watts direct current (Col. 6, lines: 65-68).

The method as claimed in claim 1 wherein forming the ultra-uniform silicides uses an extra slow rate of deposition of a silicide metal below 7.0 A per second (Col. 7, lines: 1-5).

The method as claimed in claim 1 wherein'. (*sic*) forming the ultra-uniform silicides forms an ultra-thin thickness of a silicide metal of not more than 50 A thick (Col. 3, lines: 55)."

It is respectfully submitted that claims 2-4 relate to forming an ultra-uniform silicide, and Saigal does not teach or suggest forming such an ultra-uniform silicide, as explained above.

The Examiner concludes:

"These claims are *prima facie* obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688(Fed. Cir. 1996)(claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious)."

Applicants respectfully disagree. Saigal does not teach or suggest the claimed ultra-uniform silicide based on the Applicants' showing of criticality and unexpected results relative to the prior art Saigal non-uniform silicide. Thus, the claims are not obvious based on the C.C.P.A. holdings that:

"[R]anges which overlap or lie inside ranges disclosed by the prior art may be patentable if the applicant can show criticality in the claimed range by evidence of unexpected results." (*In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (C.C.P.A. 1976) at 100 (citing *In re Malagari*, 499 F.2d 1297, 182 USPQ 549 (C.C.P.A. 1974); *In re Orfeo*, 440 F.2d 439, 169 USPQ 487 (C.C.P.A. 1971)).

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The other references cited by the Examiner showing the prior art have been considered and are not believed to disclose, teach, or suggest, either singularly or in combination, Applicants' invention as claimed.

Response to Examiner's Arguments

The Examiner states:

"Applicant's arguments filed 3/14/05 have been fully considered but they are not persuasive. Applicant argues that the Admitted Prior Art (AAPA) fails to teach an ultra uniform silicide, however this is not persuasive since the admitted prior art teaches to form a silicide layer which is self-aligned to the source and drain regions. This self-alignment implies that the silicide layer does not have varying thickness extending the silicide beyond the underlying source/drain regions and is therefore ultra uniform." [underlining for clarity]

Applicants respectfully disagree. It is respectfully submitted that it is well known in the art that "self-alignment" is unrelated to thickness but is related to location. As explained in Specification page 3, lines 8-11:

"Since the shallow trench oxide and the sidewall spacers will not react to form a silicide, the silicides are aligned over the source/drain junctions and the polysilicon gates so the process is also referred to as "self-aligned silicidation", or "salicidation"."

As would be evident from the above, even if the silicide is totally non-uniform and has a bumpy deposition, it would still be self-aligned because it would be in a specific location.

Since there is no disclosure, teaching, or suggestion of the Examiner's interpretation in the AAPA, Applicants believe it is based on the Examiner's personal knowledge and respectfully request an Examiner Affidavit disclosing the Examiner's personal knowledge regarding this limitation pursuant to 37 CFR §1.104(d)(2) (2002):

"When a rejection in an application is based on facts within the personal knowledge of an employee of the Office, the data shall be as specific as possible and the reference must be supported, when called for by the applicant, by the affidavit of such employee, and such affidavit shall be subject to contradiction or explanation by the affidavits of the applicant and other persons."

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The Examiner continues:

"Moreover, Applicant argues that the metal contacts are not taught by prior art, this is also not persuasive given the teaching of contact openings extending to the source/drain regions after completion of the transistor."

Applicants respectfully clarify the argument: the prior art cannot teach or suggest contacts to an ultra-uniform silicide since the prior art does not teach or suggest an ultra-uniform silicide.

The Examiner continues:

Lastly, Applicant argues that Saigal fails to teach an ultra uniform silicide as claimed by the Applicant. However, it is important to note that Saigal was not relied upon to teach an ultra uniform silicide."

Applicants appreciate the Examiner's clarification and agree that Saigal fails to teach an ultra-uniform silicide.

The Examiner continues:

"[R]ather Saigal was used to teach that it is known to form silicide layers of 50A and other parameters claimed by the Applicant and not specifically disclosed by the prior art."

Applicants appreciate the Examiner's clarification and point out that since Saigal fails to teach an ultra-uniform silicide, Saigal cannot teach the process parameters claimed by the Applicant that result in the ultra-uniform silicide.

The Examiner concludes:

"Applicant is requested by the Examiner to identify what reference Applicant is referring to in the admitted prior art for future prosecution."

Applicants respectfully submit that the Applicants' Response paralleled the Examiner's Rejections as the Examiner referred them to.

It is respectfully submitted that claims 1-6 are allowable under 35 USC §102(a) as not being anticipated by AAPA and under USC §103(a) as not being obvious based on AAPA in view of Saigal for the reasons given above.

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Conclusion

In view of the above, it is submitted that the claims are in condition for allowance and reconsideration of the rejections is respectfully requested. Allowance of claims 1-6 at an early date is solicited. Rejoinder and allowance of claims 7-12 at an early date is also solicited.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including any extension of time fees, to Deposit Account No. 01-0365 and please credit any excess fees to such deposit account.

Respectfully submitted,



Mikio Ishimaru
Registration No. 27,449

The Law Offices of Mikio Ishimaru
1110 Sunnyvale-Saratoga Rd., Suite A1
Sunnyvale, CA 94087
Telephone: (408) 738-0592
Fax: (408) 738-0881
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